Source Water Assessment

A Hydrogeologic Susceptibility and Vulnerability Assessment for Indian House Drinking Water System, Indian Valley, Alaska PWSID # 213441.001

DRINKING WATER PROTECTION PROGRAM REPORT # 331
Alaska Department of Environmental Conservation

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By URS Corporation

DRINKING WATER PROTECTION PROGRAM REPORT # 331

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Source Water Assessment for Indian House Source of Public Drinking Water, Indian Valley, Alaska

By URS Corporation

Drinking Water Protection Program
Alaska Department of Environmental Conservation

EXECUTIVE SUMMARY

The Indian House is a Class B (transient/non-community) water system consisting of one well located at mile 103.5 of the Seward Highway in Indian, Alaska. Identified potential and current sources of contaminants for Indian House public drinking water source include: large capacity septic systems, industrial process injection wells, meat processing, nonresidential heating oil tanks, municipal parks, and highways and roads. These identified potential and existing sources of contamination are considered sources of bacteria and viruses, nitrates and/or nitrites, and volatile organic chemicals. Overall, the public water sources for Indian House received a vulnerability rating of **High**, for bacteria and viruses, nitrates and nitrites, and volatile organic chemicals.

INTRODUCTION

The Alaska Department of Environmental Conservation (ADEC) is completing source water assessments for all public drinking water sources in the State of Alaska. The purpose of this assessment is to provide owners and/or operators, communities, and local governments with information they can use to preserve the quality of Alaska's public drinking water supplies. The results of this source water assessment can be used to decide where voluntary protection efforts are needed and feasible, and also what efforts will be most effective in reducing contaminant risks to your water system. URS Corporation has been contracted to perform these assessments under the supervision of ADEC.

This source water assessment combines a review of the natural conditions at the site and the potential and existing contaminant risks. These are combined to determine the overall vulnerability of the drinking water source to contamination.

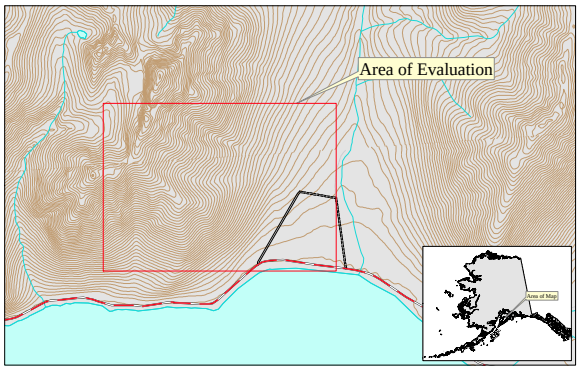
DESCRIPTION OF THE TURNAGAIN ARM, ALASKA

Location

The Turnagain Arm is an estuary, which begins where the Cook Inlet divides near Anchorage and extends southeast to the junction of the Kenai Peninsula. The Seward Highway travels along the coast of the arm, connecting Anchorage with the communities of Indian, Bird, Girdwood, and Portage, all located within the Municipality of Anchorage. The communities of Hope and Sunrise are located on the southern side of the Turnagain Arm within the Kenai Peninsula Borough. Most of these communities (Indian, Bird Creek and Girdwood) are also contained within the Chugach State Park. The area north of the arm is bordered by the Chugach Mountains and to the south are the Kenai Mountains. The highest peak, called Turnagain Arm Pass (988 feet) is located almost directly south of Girdwood on the northern portion of the Kenai Peninsula.

The Turnagain Arm was formed mainly by the erosive force of glaciers.

Figure 1



Precipitation

Due to the marine air coming from the Gulf of Alaska and Prince William Sound, precipitation tends to be more abundant and winter temperatures warmer in the

Turnagain Arm area. Winds are also relatively stronger and more persistent *(Chugach State Park Master Plan, 1980).*

The communities of Bird and Indian have an annual average precipitation of 43.1 inches, with the highest amount of precipitation occurring in the fall.

Topography and Drainage

The topography in the site vicinity is typical of valleys formed by glaciation, with a relatively flat to gently sloping valley bottom and steep sidewalls. Relatively steep mountainous terrain comprises more than 90% of the watershed. Elevations range from sea level to just over 5,000 feet.

The Turnagain Arm is known for its hiking trails, scenic views and wildlife. Dall sheep, beluga whales, brown and black bear and moose can sometimes be seen from the highway. Bore tides (high tides reaching 30 feet) can also be seen from Beluga Point and south to Girdwood. Several creeks drain into the Turnagain Arm, including McHugh Creek, Bird Creek, Indian Creek and Glacier Creek *(Chugach State Park Master Plan, 1980 and Milepost, 2000*).

Bird Creek is a spawning stream for pink salmon, some king salmon and Dolly Varden. Bird Creek also has a fantastic silver salmon run in the summer and is therefore a very popular fishing spot *(Milepost, 2000).*

Indian Creek is a also a spawning stream for pink salmon, some king salmon and Dolly Varden. It is great fishing spot for pink salmon and some coho salmon and rainbow trout *(Milepost, 2000).*

Groundwater

According to the Major Ecosystems of Alaska map (JFSLUPC, 1973), this area lies within the southcentral hydrologic region and the Cook Inlet sub-region. Surface water and groundwater flow is abundant in this area. Based on the USGS, Water Resources Division, groundwater database, groundwater in this area is designated as having existing beneficial uses for domestic and commercial applications.

Although the quality can vary significantly in a short distance, groundwater supplies are abundant in the area. Many homes and businesses in the area rely on individual wells for their water supply. Most of these wells are deep with depths of more than 100 feet up to 390 feet. Static water levels in many of these wells are between 20 feet to 130 feet below the surface.

Geology and Soils

Various Quaternary-age surficial deposits are found in the general area. The origin of these deposits is predominantly glacial, with components of alluvial, colluvial, and lacustrine deposition (Winkler, 1992). The glacier ice mass deposited silt, sand, gravel, cobbles and boulders during multiple glacial advancements and recessions. The soils deposited during the glacial advancements were consolidated by the weight of the ice. During the recessional phase of glaciation, soils consolidated by the ice mass were probably eroded to some degree by melt water, and unconsolidated alluvial materials were deposited.

Based on previous geotechnical investigations in the surrounding area, it is believed that area is underlain by rock of Tertiary age which rests on Mesozoic rocks about 30,000 feet thick. Bedrock in the area is covered by unconsolidated glaciolacustrine and alluvial deposits remaining after Pleistocene glaciers moved through the valley.

INDIAN HOUSE
PUBLIC DRINKING WATER SYSTEM

Indian House is a Class B (transient/non-community) water system. The system consists of one well located at mile 103.5 of the Seward Highway in Indian, Alaska (T10N, R1W, Section 6). This area is at an elevation of approximately 50 feet above sea level.

Information contained in ADEC files for the Indian, the well was installed at a total depth of approximately 47 feet below ground surface installation. The date of the installation was not provided. The size of the well casing is also unknown. No information was provided to indicate if the well was installed with a cap providing a sanitary seal. A properly installed sanitary seal may provide protection against contaminants from entering the source waters at the well casing. It is also unknown if the land surface is appropriately sloped away from the well providing adequate surface water drainage, and if the well was grouted according to ADEC regulations. Proper grouting provides added protection against contaminants traveling along the well casing and into source waters.

This system operates year-round and serves more than 200 non-residents through one service connection.

INDIAN HOUSE DRINKING WATER PROTECTION AREA

In order to evaluate whether a drinking water source is at risk, we must first evaluate what are the most likely pathways for surface contamination to reach the

groundwater. Some areas are more likely to allow contamination to reach the well than others. These areas are determined by looking at the characteristics of the soil, groundwater, aquifer, and well.

The most probable area for contamination to reach the drinking water well is the area that contributes water to the well, the groundwater recharge area. This area is designated as the Drinking Water Protection Area (DWPA). Because a release of contaminants within the DWPA are most likely to impact the drinking water well, this area will serve as the focus for voluntary protection efforts.

An analytical calculation was used to determine the size and shape of the DWPA. The input parameters describing the attributes of the aquifer in this calculation were adopted from the U.S. Geological Survey (*Patrick, Brabets, and Glass, 1989*), and State of Alaska Department of Water Resources (*Jokela et. al., 1991*). Additional methods were also used to take into account any uncertainties in groundwater flow and aquifer characteristics to arrive at a meaningful DWPA (Please refer to the Guidance Manual for Class Bs for additional information).

The DWPAs established for wells by the ADEC are separated into four zones. These zones correspond to differences in the time-of-travel (TOT) of the water moving through the aquifer to the well. The time of travel for contaminants within the water varies and is dependent on the physical and chemical characteristics of each contaminant. The following is a summary of the four DWPA zones and the calculated time-of-travel for each:

Table 1. Definition of Zones

Zone	Definition
A	¼ the distance for the 2-yr. TOT
B	Less than the 2 year TOT
C	Less Than the five year TOT
D	Less than the 10 year TOT

As an example, water moving through the aquifer in Zone B will reach the well in less than 2 years from the time it crosses the outer limit of Zone B.

Zone A also incorporates the area downgradient from the well to take into account the area of the aquifer that is influenced by pumping of the well. Water within the aquifer in Zone A will reach the well in several hours to several months.

INVENTORY OF POTENTIAL AND EXISTING CONTAMINANT SOURCES

The Drinking Water Protection Program has completed an inventory of potential and existing sources of contamination within the Indian House DWPA. This inventory was completed through a search of agency records and other publicly available information. Potential sources of contamination to the drinking water aquifer include a wide range of categories and types. Potential drinking water contaminants are found within agricultural, residential, commercial, and industrial areas, but can also occur within areas that have little or no development.

For the basis of all Class B assessments, three categories of drinking water contaminants were inventoried. They include:

- Bacteria and viruses;
- Nitrates and/or nitrites; and
- Volatile organic chemicals.

Inventoried potential sources of contamination within Zones A and B were associated with residential and light industrial type activities. The sources are summarized in the tables in Appendix B.

RANKING OF CONTAMINANT RISKS

Once the potential and existing sources of contamination have been identified, they are sorted and ranked according to what type and level of risk they represent. Ranking of contaminant risks for a "potential" or "existing" source of contamination is a function of toxicity and volumes of specific contaminants associated with that source. Further, contaminant risks are a function of the number and density of those types of contaminant sources as well as the proximity of those sources to the well.

VULNERABILITY OF INDIAN HOUSE DRINKING WATER SOURCE

Vulnerability of a drinking water source to contamination is a combination of two factors:

- Natural susceptibility; and
- Contaminant risks.

Each of the three categories of drinking water contaminants has been analyzed and an overall vulnerability score of 0 to 100 is ultimately assigned:

Natural Susceptibility (0 – 50 points)

+

Contaminant Risks (0 – 50 points)

=

Vulnerability of the
Drinking Water Source to Contamination (0 – 100).

A score for the Natural Susceptibility is achieved by analyzing the properties of the well and the aquifer.

Susceptibility of the Wellhead (0 – 25 Points)

+

Susceptibility of the Aquifer (0 – 25 Points)

=

Natural Susceptibility (Susceptibility of the Well)
(0 – 50 Points)

The well for Indian House is completed in an unconfined aquifer setting. Because an unconfined aquifer is recharged by surface water and precipitation that migrates downward from the surface, contaminants at the surface have the potential to adversely impact this aquifer. Table 2 shows the Overall Susceptibility score and rating for Indian House.

Table 2. Natural Susceptibility - Susceptibility of the Wellhead and Aquifer to Contamination

	Score	Rating
Susceptibility of the Wellhead	0	Low
Susceptibility of the Aquifer	25	Very High
Natural Susceptibility	25	Medium

Contaminant risks to a drinking water source depend on the type, number or density, and distribution of contaminant sources. This data has been derived from an examination of existing or historical contamination that has been detected at the drinking water source through routine sampling. It also evaluates potential sources of contamination. Table 3 summarizes the Contaminant Risks for each category of drinking water contaminants.

Table 3. Contaminant Risks

Category	Score	Rating
Bacteria and Viruses	50	Very High
Nitrates and/or Nitrites	50	Very High
Volatile Organic Chemicals	40	Very High

Appendix D contains eight charts, which together form the 'Vulnerability Analysis' for a source water assessment for a public drinking water source. Chart 1 analyzes the 'Susceptibility of the Wellhead' to contamination by looking at the construction of the well and its surrounding area. Chart 2 analyzes the 'Susceptibility of the Aquifer' to contamination by looking at the naturally occurring attributes of the water source and influences on the groundwater system that might lead to contamination. Chart 3 analyzes 'Contaminant Risks' for the drinking water source with respect to bacteria and viruses. The 'Contaminant Risks' portion of the analysis considers potential sources of contaminants as well as a review of contamination that has or may have occurred, but has not arrived or been detected at the well. Lastly, Chart 4 contains the 'Vulnerability Analysis for Bacteria and Viruses'. Charts 5 through 8 contain the Contaminant Risks and Vulnerability Analyses for nitrates and nitrites and volatile organic chemicals, respectively.

Table 3 contains the overall vulnerability scores (0 – 10) and ratings for each of the three categories of drinking water contaminants. Note: scores are rounded off to the nearest five.

Table 4. Overall Vulnerability of Indian House to Contamination by Category

Category	Score	Rating
Bacteria and Viruses	75	High
Nitrates and Nitrites	75	High
Volatile Organic Chemicals	65	High

Tables 2 through 5 in Appendix B contain the ranking of potential and existing sources of contamination with respect to bacteria and viruses, nitrates and/or nitrites, and volatile organic chemicals.

The large capacity septic systems, industrial process injection wells, meat processing, nonresidential heating oil tanks, nonresidential heating oil tanks, municipal parks, and highways and roads create a risk increase for the bacteria and viruses, and nitrates and nitrites contaminant categories

Only a small amount of bacteria and viruses are required to endanger public health. Bacteria and viruses were not detected during recent water sampling events of the system at Indian House in 2000, and 2001.

Nitrates and/or nitrites are found in natural background concentration at this site, as elsewhere throughout Alaska. Nitrate concentrations in uncontaminated groundwater are typically less than 2 milligrams per liter (mg/L) and are derived primarily from the

decomposition of organic matter in soils [Wang, Strelakos, Jokela, 2000].

Sampling history for Indian House well indicates that low concentrations of nitrate have been detected (See Chart 5 - Contaminant Risks for Nitrates and/or Nitrites in Appendix D). Existing nitrate concentration is approximately 0.9 mg/L or 9% of the Maximum Contaminant Level (MCL) of 10mg/L. The MCL is the maximum level of contaminant that is allowed to exist in drinking water and still be consumed by humans without harmful health effects. Due to the high solubility and weak retention by soil, nitrates are very mobile, moving at approximately the same rate as water. Though existing nitrate contamination was detected at the site, concentrations remain at very safe levels with respect to human health.

SUMMARY

A *Source Water Assessment* has been completed for the sources of public drinking water serving Indian House. The overall vulnerability of this source to contamination is **High**, for bacteria and viruses, nitrates and nitrites, and volatile organic chemicals. This assessment of contaminant risks can be used as a foundation for local voluntary protection efforts as well as a basis for the continuous efforts on the part of Indian House to protect public health. It is anticipated that *Source Water Assessments* will be updated every five years to reflect any changes in the vulnerability and/or susceptibility of Indian House public drinking water source.

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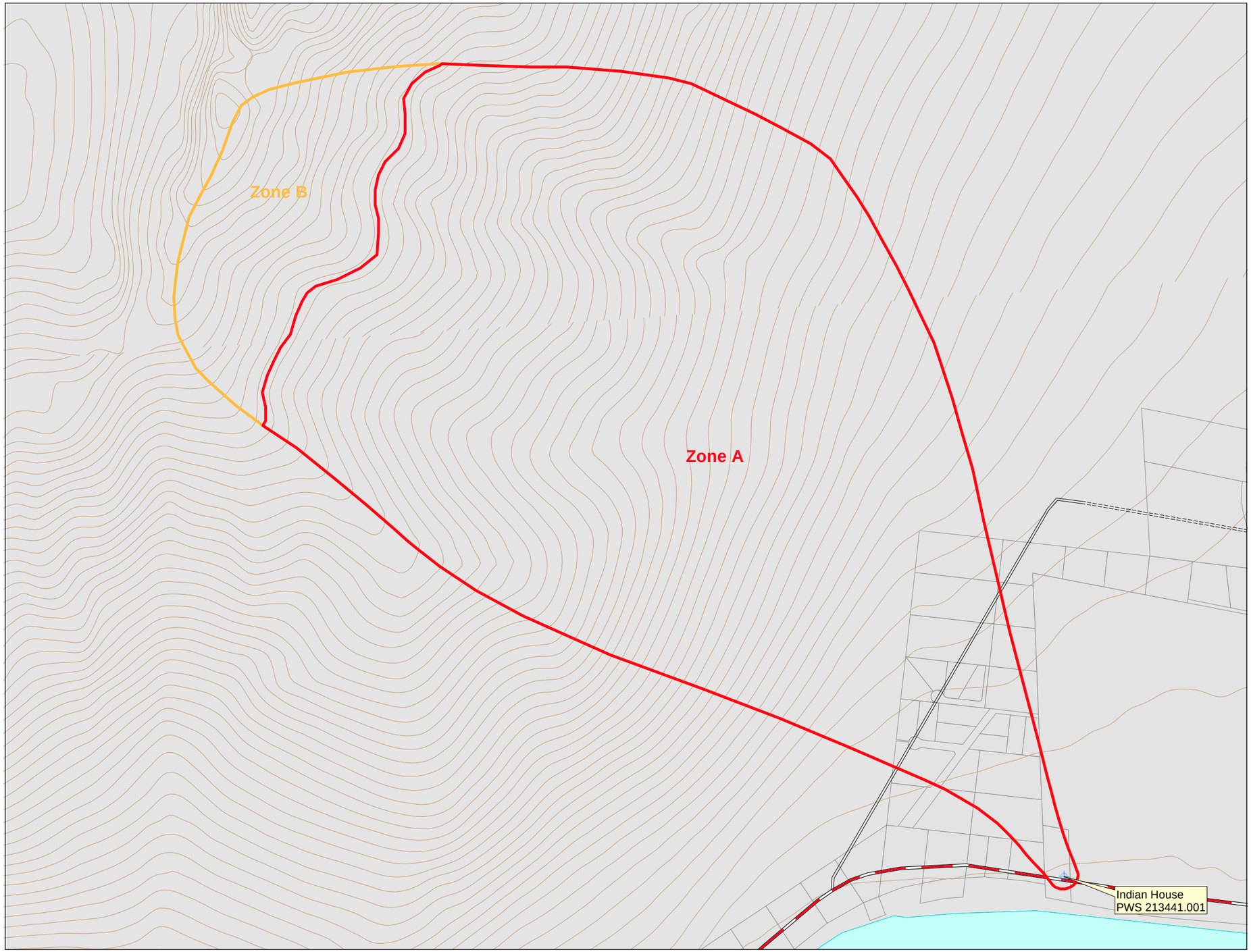
APPENDIX A

Indian House
Drinking Water Protection Area
(Map 1)

Drinking Water Protection Areas for the Public Water Well System for PWS # 213441.001 Indian House



LEGEND

- Public Water System Well

Groundwater Protection Zones

- Zone A – Several Months Travel Time
- Zone B – Less Than 2 Years Travel Time

Hydrography/Physical

- Parcels
- Stream
- Aqueduct or Pipeline
- Lake or Pond
- Glacier
- Contours (approx. 70 ft.)

Transportation

- Primary Route (Class 1)
- Secondary Route (Class 2)
- Road (Class 3)
- Road (Class 4)
- Road (Class 5, Four-wheel drive)
- Road Ferry Crossing

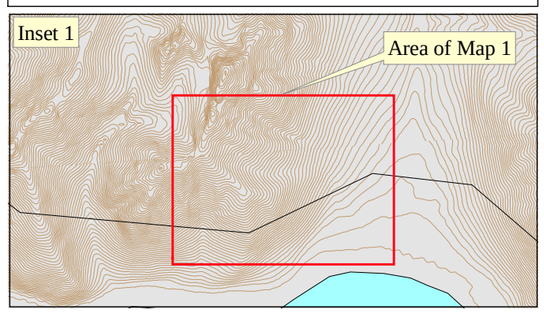
Data Sources:
Contaminant Sources, Public Water System Wells, Contours
Alaska Department of Environmental Conservation (ADEC)

Parcels
Kenai Peninsula Borough

All other data
United States Geological Survey (USGS)

Drinking Water Protection Areas based on ADEC
Calculation Spreadsheet.

URS Corporation does not guarantee the accuracy or validity of the data provided.



0 875 1,750 3,500 5,250 7,000 Feet

Indian House PWS 213441.001

APPENDIX B

Contaminant Source Inventory and Risk Ranking for Indian House (Tables 1-4)

Table 1 *Contaminant Source Inventory for* ***PWSID 213441.001***

Indian House

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Location*	*Map Number*	*Comments*
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A		1	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-02	A		1	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-03	A		1	
Injection wells (Class V) Industrial Process Water & Water Disposal Wells	D40	D40-01	A		1	
Meat processing	N05	N05-01	A		1	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A		1	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-02	A		1	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-03	A		1	
Municipal or city parks (with green areas)	X04	X04-01	A		1	
Highways and roads, paved (cement or asphalt)	X20	X20-01	A		1	
Highways and roads, paved (cement or asphalt)	X20	X20-02	A		1	

Table 2

Contaminant Source Inventory and Risk Ranking for Indian House

Sources of Bacteria and Viruses

PWSID 213441.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Injection wells (Class V) Industrial Process Water & Water Disposal Wells	D40	D40-01	A	High	1		1	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	High	2		1	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-02	A	High	3		1	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-03	A	High	4		1	
Meat processing	N05	N05-01	A	Medium	5		1	
Municipal or city parks (with green areas)	X04	X04-01	A	Medium	6		1	
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	Low	7		1	
Highways and roads, paved (cement or asphalt)	X20	X20-02	A	Low	8		1	

Table 3

Contaminant Source Inventory and Risk Ranking for Indian House

Sources of Nitrates/Nitrites

PWSID 213441.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Injection wells (Class V) Industrial Process Water & Water Disposal Wells	D40	D40-01	A	High	1		1	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	High	2		1	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-02	A	High	3		1	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-03	A	High	4		1	
Municipal or city parks (with green areas)	X04	X04-01	A	Medium	5		1	
Meat processing	N05	N05-01	A	Low	6		1	
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	Low	7		1	
Highways and roads, paved (cement or asphalt)	X20	X20-02	A	Low	8		1	

Table 4

Contaminant Source Inventory and Risk Ranking for Indian House

Sources of Volatile Organic Chemicals

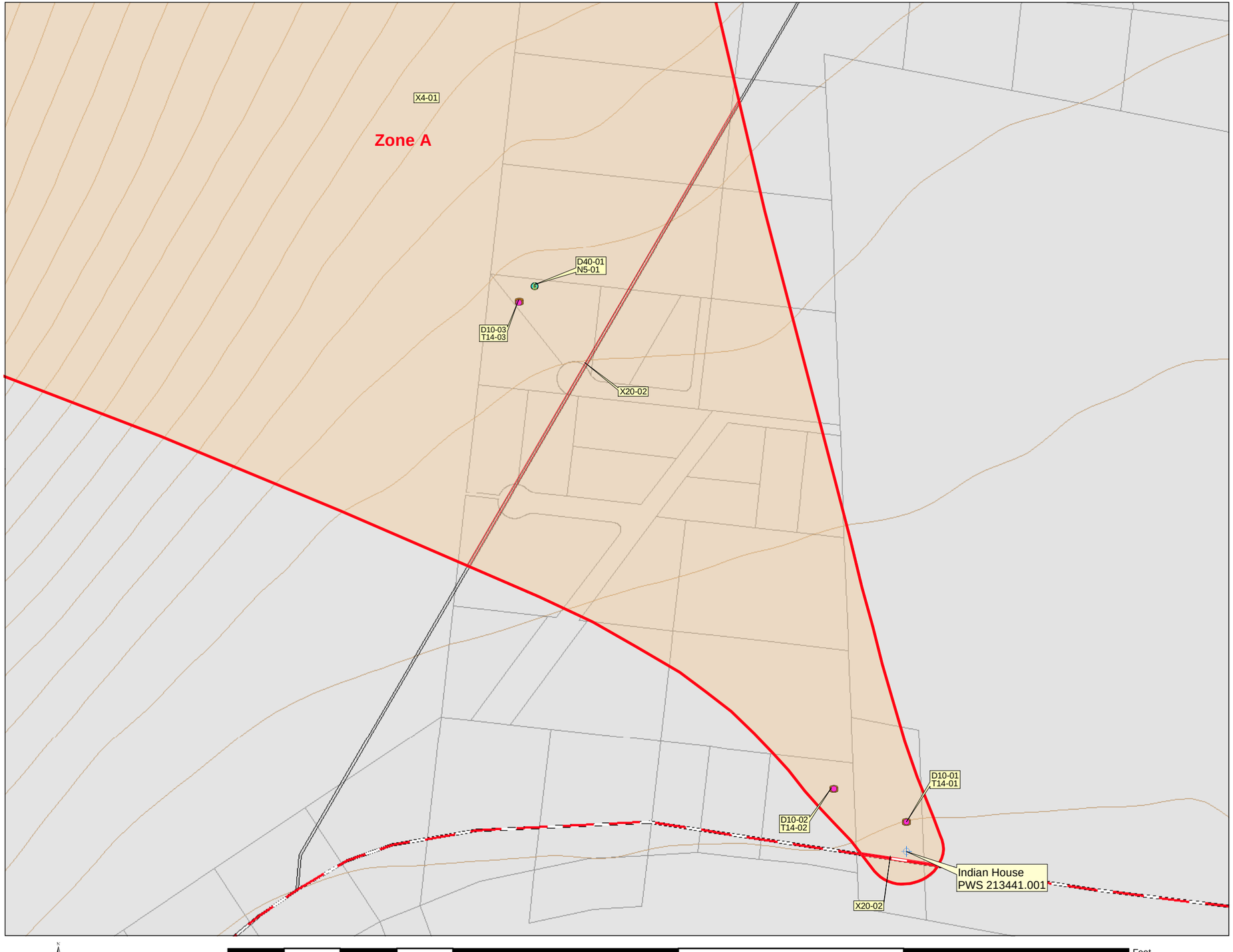
PWSID 213441.001

Contaminant Source Type	*Contaminant Source ID*	*CS ID tag*	*Zone*	*Risk Ranking for Analysis*	*Overall Rank after Analysis*	*Location*	*Map Number*	*Comments*
Injection wells (Class V) Industrial Process Water & Water Disposal Wells	D40	D40-01	A	High	1		1	
Meat processing	N05	N05-01	A	Medium	2		1	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-01	A	Low	3		1	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-02	A	Low	4		1	
Tanks, heating oil, nonresidential (aboveground)	T14	T14-03	A	Low	5		1	
Highways and roads, paved (cement or asphalt)	X20	X20-01	A	Low	6		1	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-01	A	Low	7		1	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-02	A	Low	8		1	
Highways and roads, paved (cement or asphalt)	X20	X20-02	A	Low	9		1	
Injection wells (Class V) Large-Capacity Septic System (Drainfield Disposal Method)	D10	D10-03	A	Low	10		1	

APPENDIX C

Indian House
Drinking Water Protection Area
and Potential and Existing Contaminant Sources
(Map 2)

Drinking Water Protection Areas for the Public Water Well System for PWS # 213441.001 Indian House
Showing Potential and Existing Sources of Contamination



LEGEND

Public Water System Well

Groundwater Protection Zones

Zone A – Several Months Travel Time

Zone B – Less Than 2 Years Travel Time

Contaminant Sources

Injection wells (Class V) Industrial Process Water & Water Disposal Wells (D40)

Meat processing (N5)

Injection Wells (ClassV) Septic System (Drainfield Disposal) (D10)

Tanks, heating oil, non residential (aboveground) (T14)

Highways and roads, paved (X20)

Municipal or City Parks (X4)

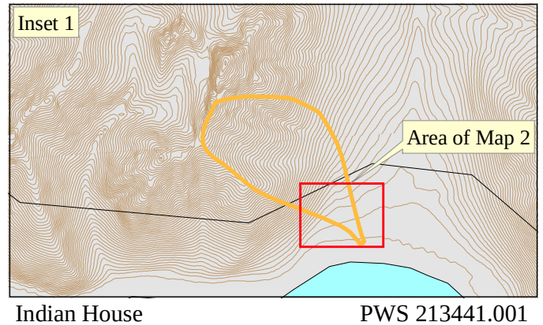
Data Sources:
Contaminant Sources, Public Water System Wells, Contours
Alaska Department of Environmental Conservation (ADEC)

Parcels
Kenai Peninsula Borough

All other data
United States Geological Survey (USGS)

Drinking Water Protection Areas based on ADEC
Calculation Spreadsheet.

URS Corporation does not guarantee the accuracy or validity of the data provided.



Indian House PWS 213441.001

0 335 670 1,340 2,010 2,680 Feet

APPENDIX D

Vulnerability Analysis for Indian House Public Drinking Water Source

(Charts 1-8)

Chart 1. Susceptibility of the wellhead - Indian House (213441.001)

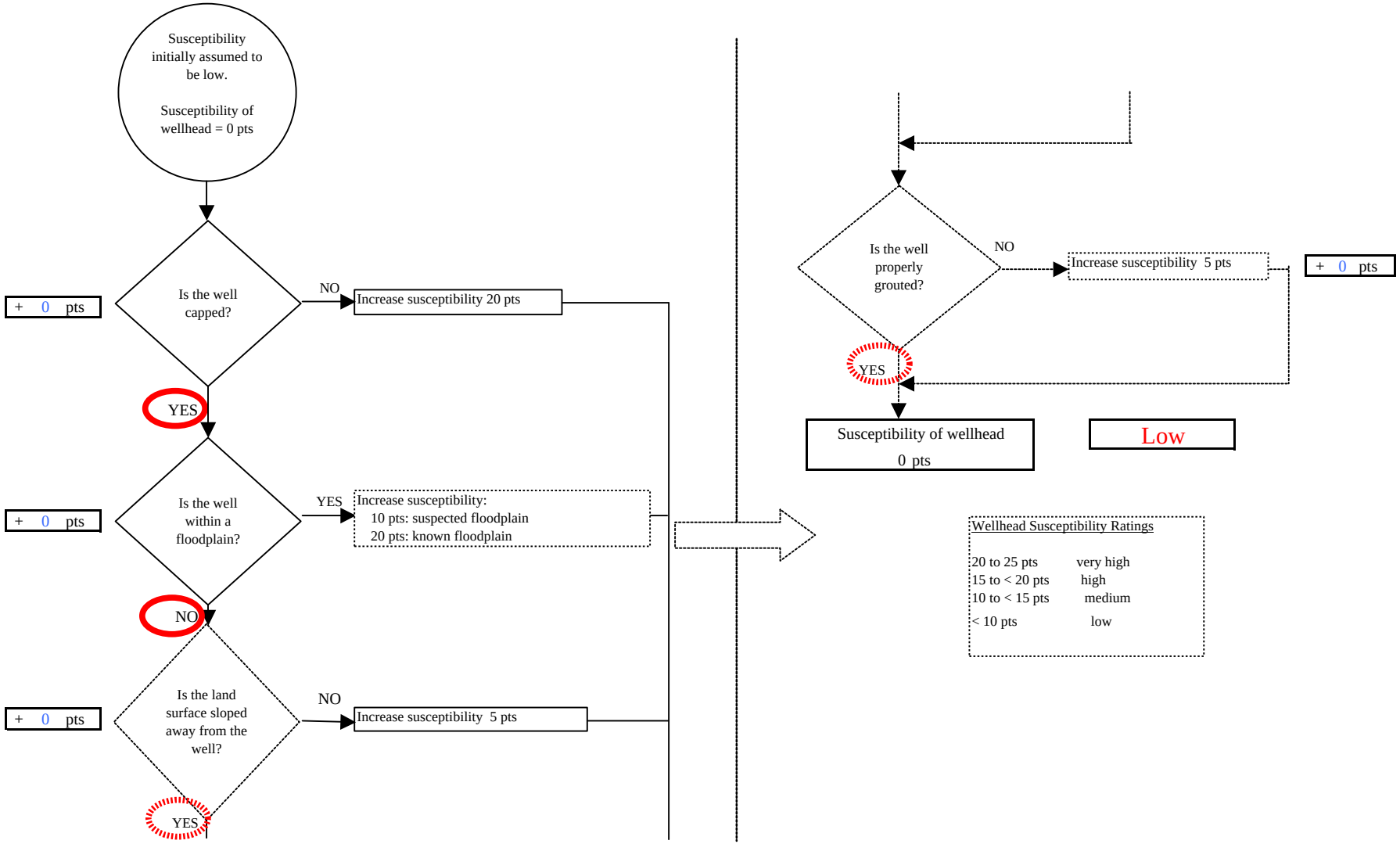


Chart 2. Susceptibility of the aquifer - Indian House (213441.001)

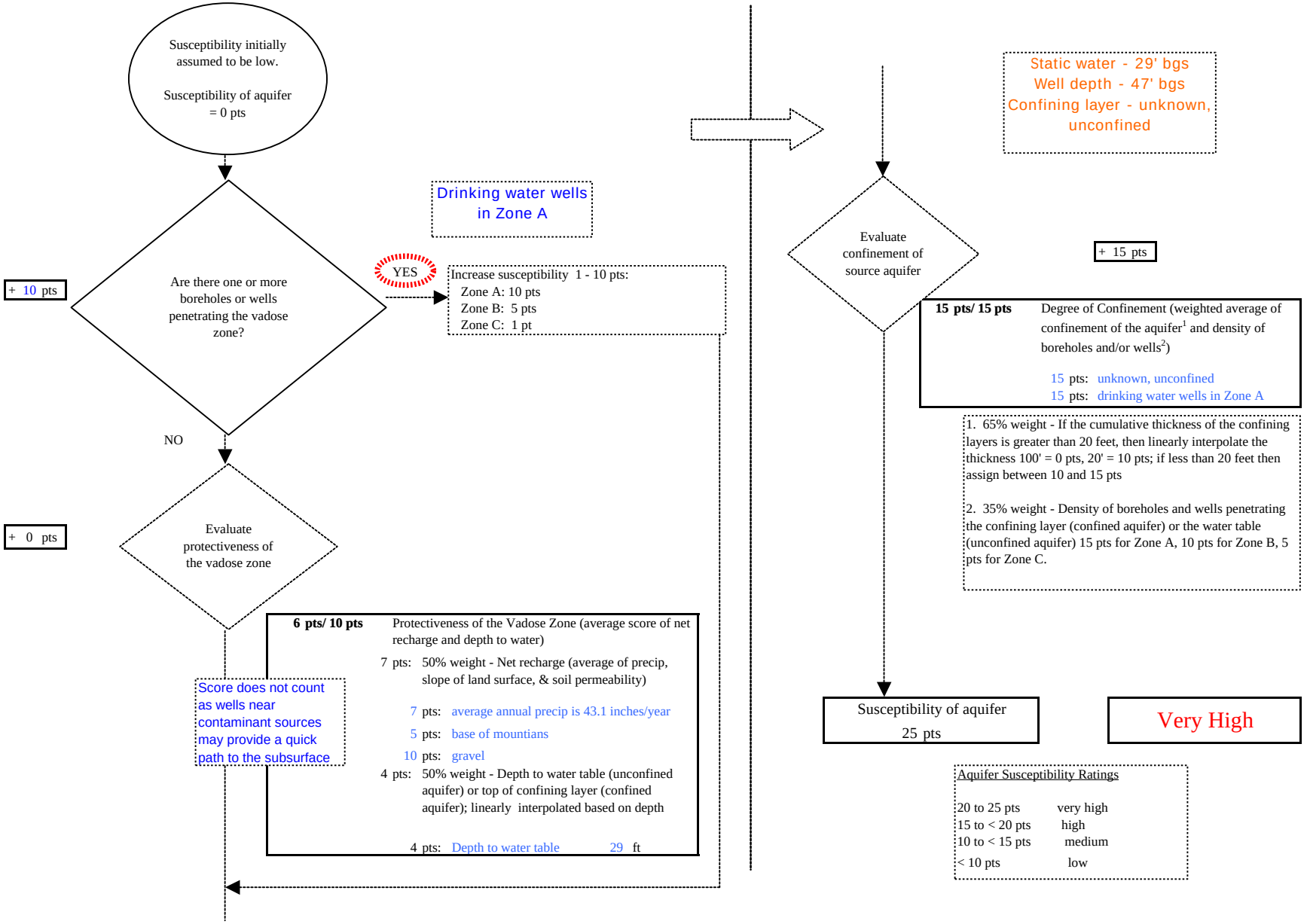
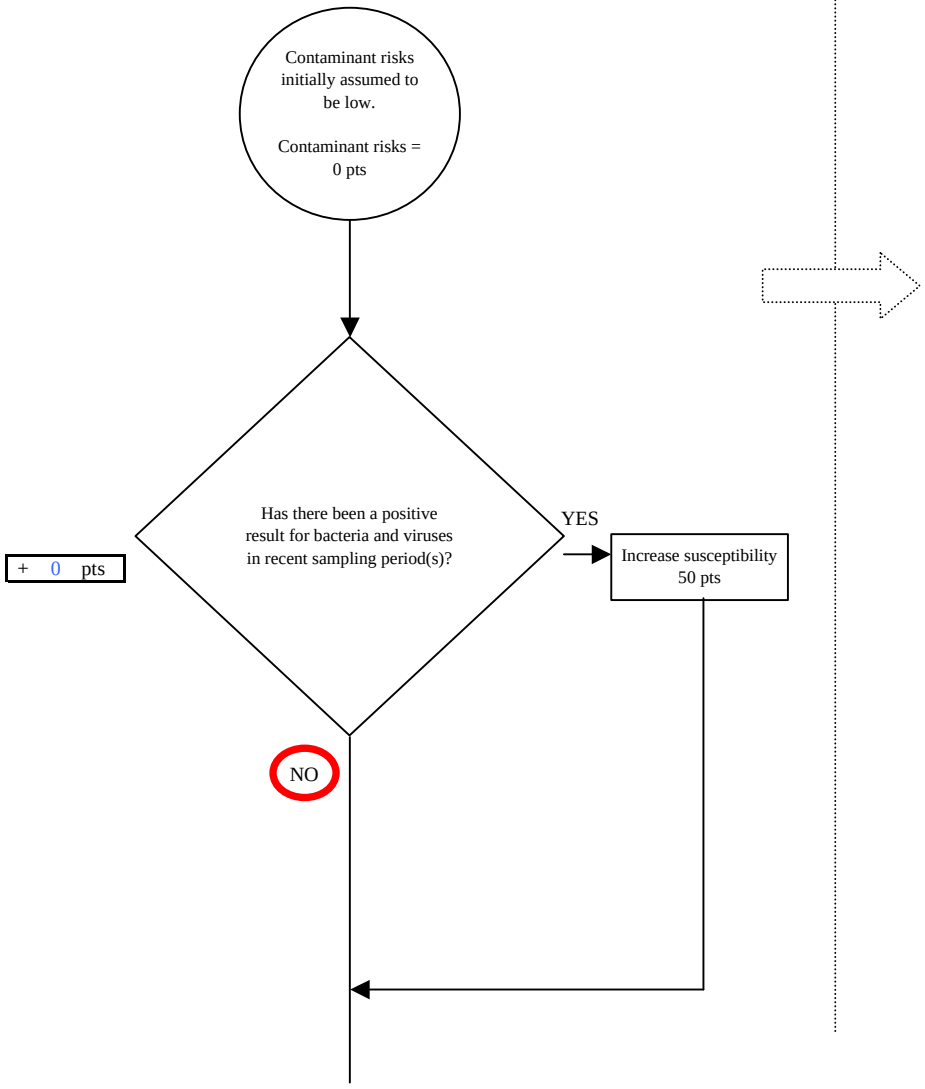
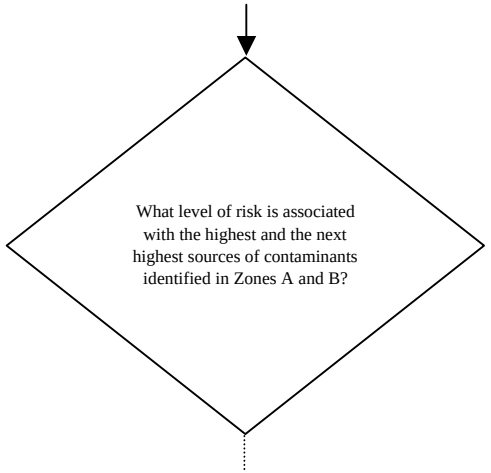


Chart 3. Contaminant risks for Indian House (213441.001) - Bacteria & Viruses





+ 40 pts

Risk Rankings for Contaminant Sources Identified in Zones A and B

	Zone A	Zone B	Total
Very Highs(s)	0	0	0
High(s)	4	0	4
Medium(s)	2	0	2
Low(s)	1	0	1

	LOW 10 pts	**MEDIUM** 20 pts	**HIGH** 30 pts	**VERY HIGH** 40 pts
LOW	[3] 10 sources + 10 pts	≥ 10 sources + 5 pts	≥ 20 sources + 5 pts	----
MEDIUM	----	≥ 2 sources + 5 pts	≥ 5 sources + 5 pts	≥ 10 sources + 5 pts
HIGH	----	----	≥ 1 source + 10 pts	≥ 2 sources + 10 pts
VERY HIGH	----	----	----	≥ 1 source + 10 pts

Matrix Score 40

Note: Septic systems, sewerlines, and roads are each assigned a risk ranking for each individual contaminant source in the CSI. The VA, however, counts these contaminant sources as a group and assigns a calculated number of either "lows" or "mediums" based on the density.

Chart 3. Contaminant risks for Indian House (213441.001) - Bacteria & Viruses

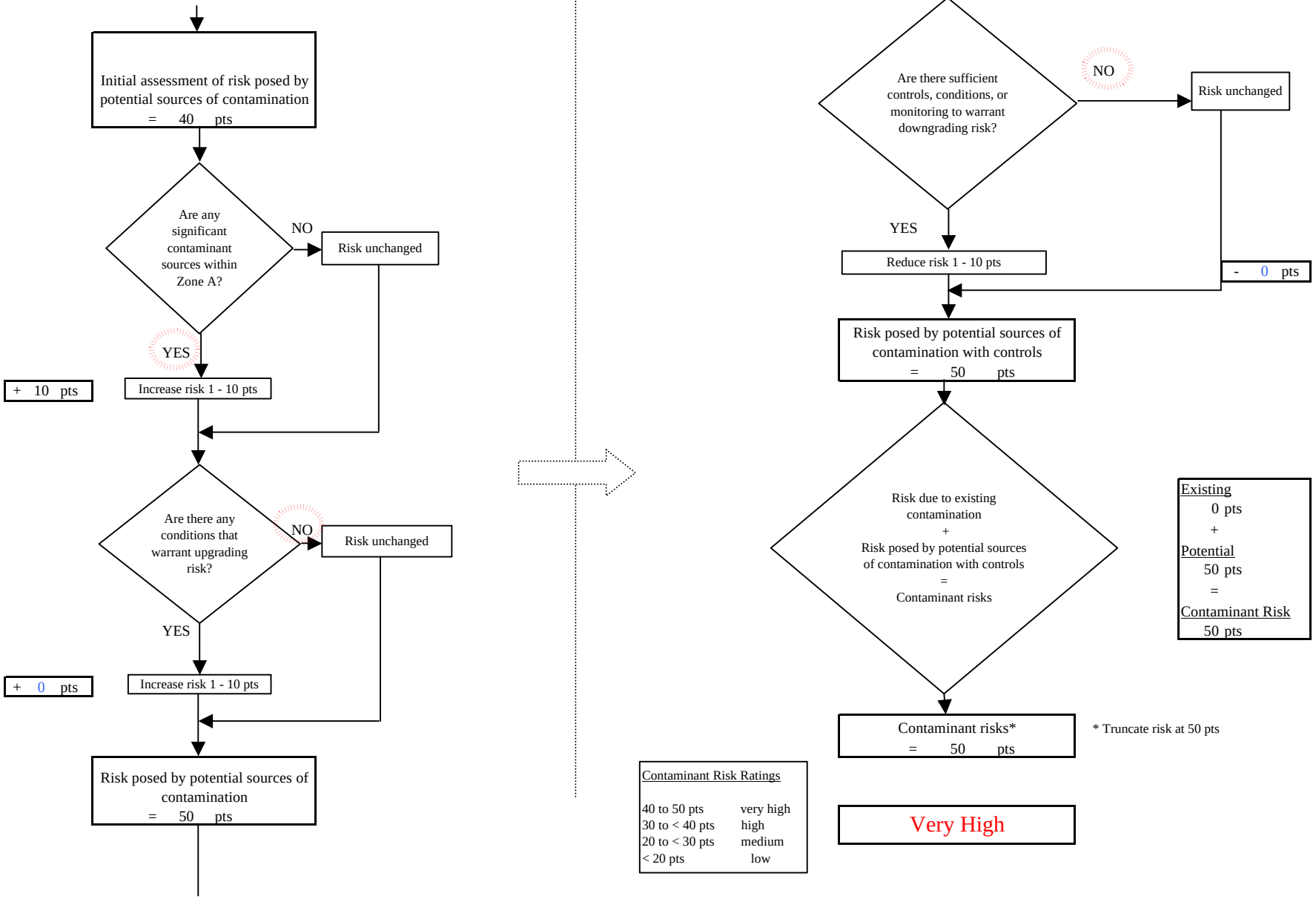


Chart 4. Vulnerability analysis for Indian House (213441.001) - Bacteria & Viruses

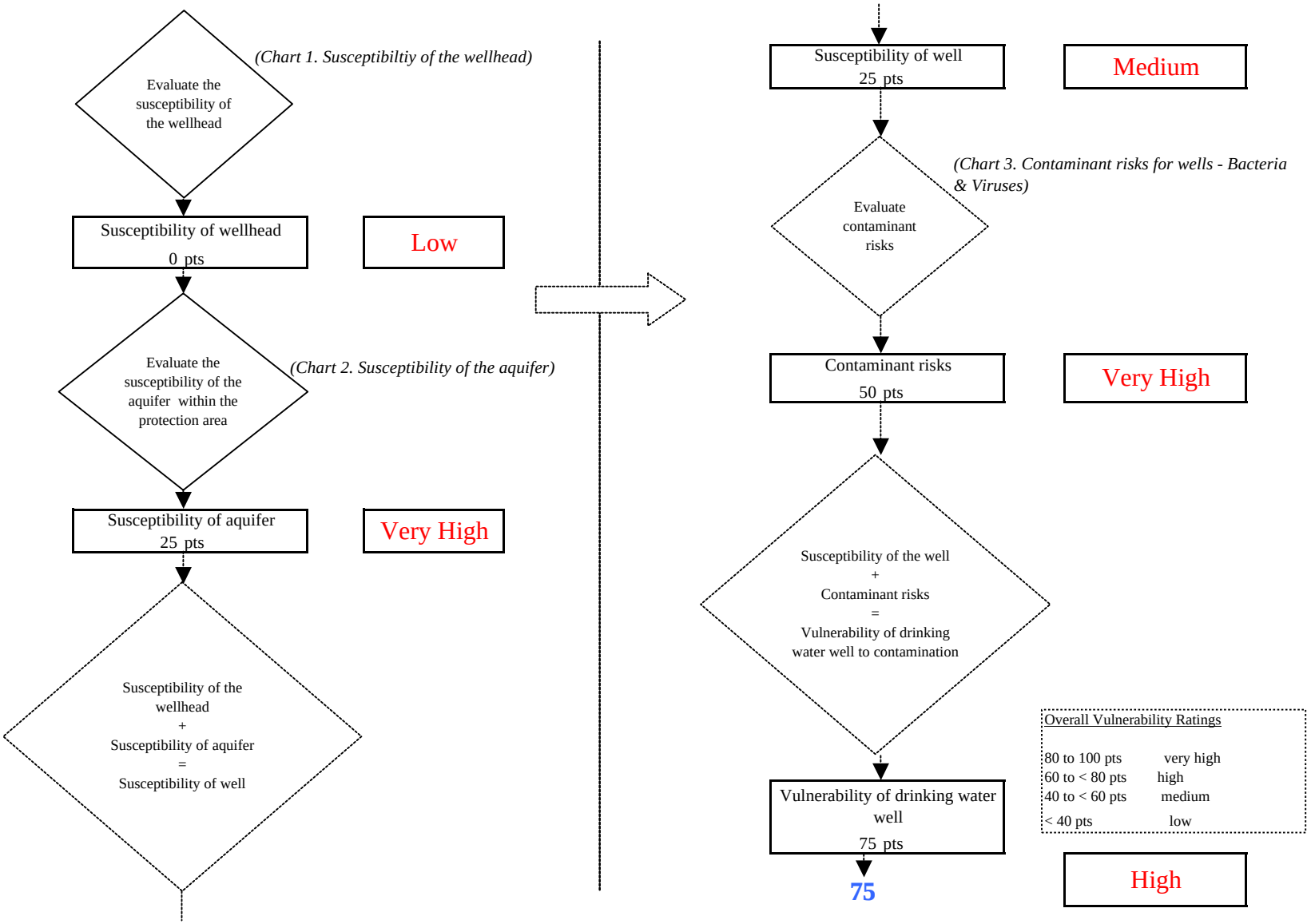


Chart 5. Contaminant risks for Indian House (213441.001) - Nitrates and Nitrites

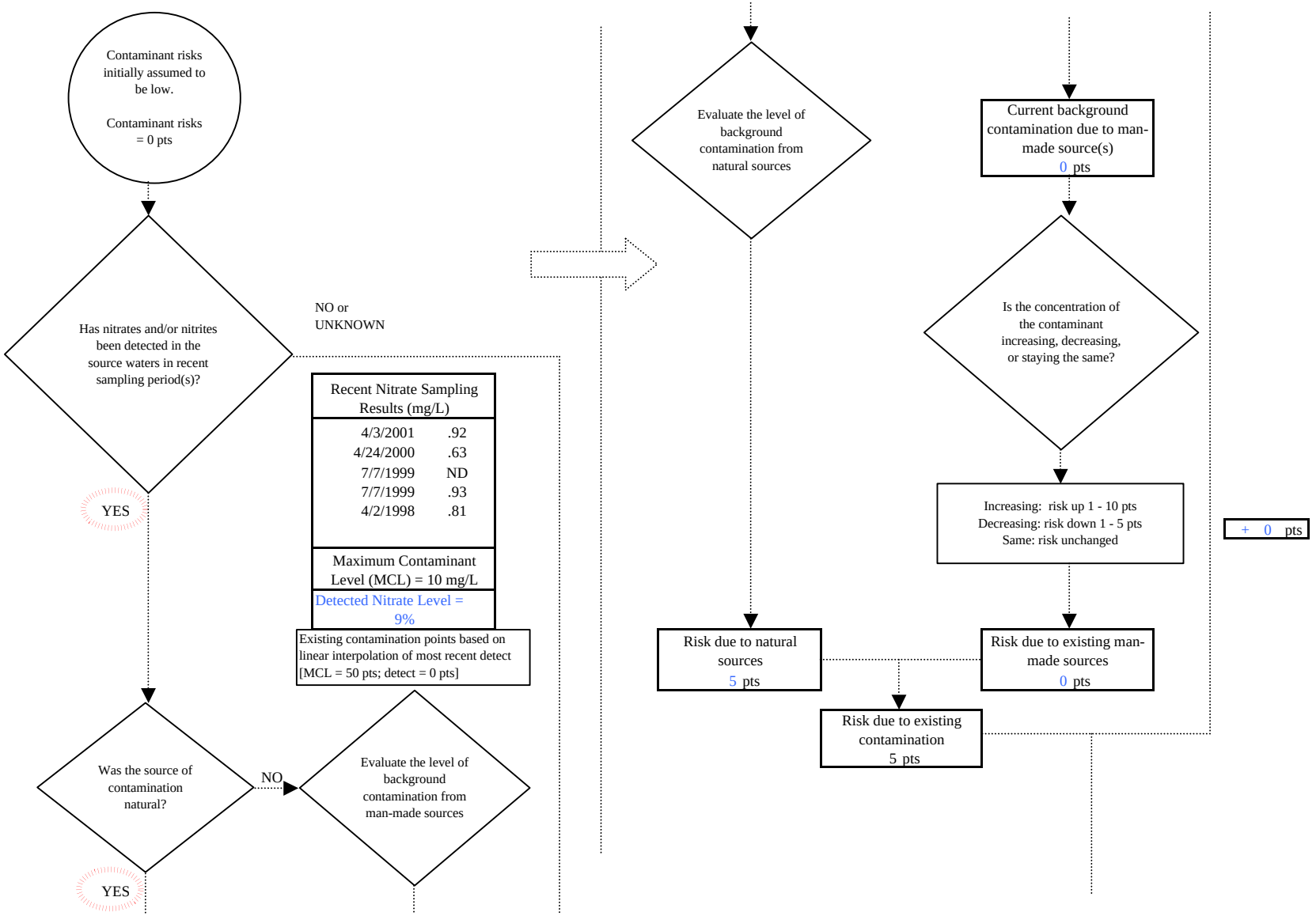


Chart 5. Contaminant risks for Indian House (213441.001) - Nitrates and Nitrites

+ 40 pts

What level of risk is associated with the highest and the next highest risk sources(s) of contaminants identified in Zones A, B and C?

Risk Levels for Contaminant Sources identified in Zones A, B and C

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	4	0	4
Medium(s)	1	0	1
Low(s)	2	0	2

	LOW 10 pts	**MEDIUM** 20 pts	**HIGH** 30 pts	**VERY HIGH** 40 pts
LOW	[3] 10 sources + 10 pts	≥ 10 sources + 5 pts	≥ 20 sources + 5 pts	----
MEDIUM	----	≥ 2 sources + 5 pts	≥ 5 sources + 5 pts	≥ 10 sources + 5 pts
HIGH	----	----	≥ 1 source + 10 pts	≥ 2 sources + 10 pts
VERY HIGH	----	----	----	≥ 1 source + 10 pts

Matrix Score 40

Note: Septic systems, sewerlines, and roads are each assigned a risk ranking for each individual contaminant source in the CSI. The VA, however, counts these contaminant sources as a group and assigns a calculated number of either "lows" or "mediums" based on the density.

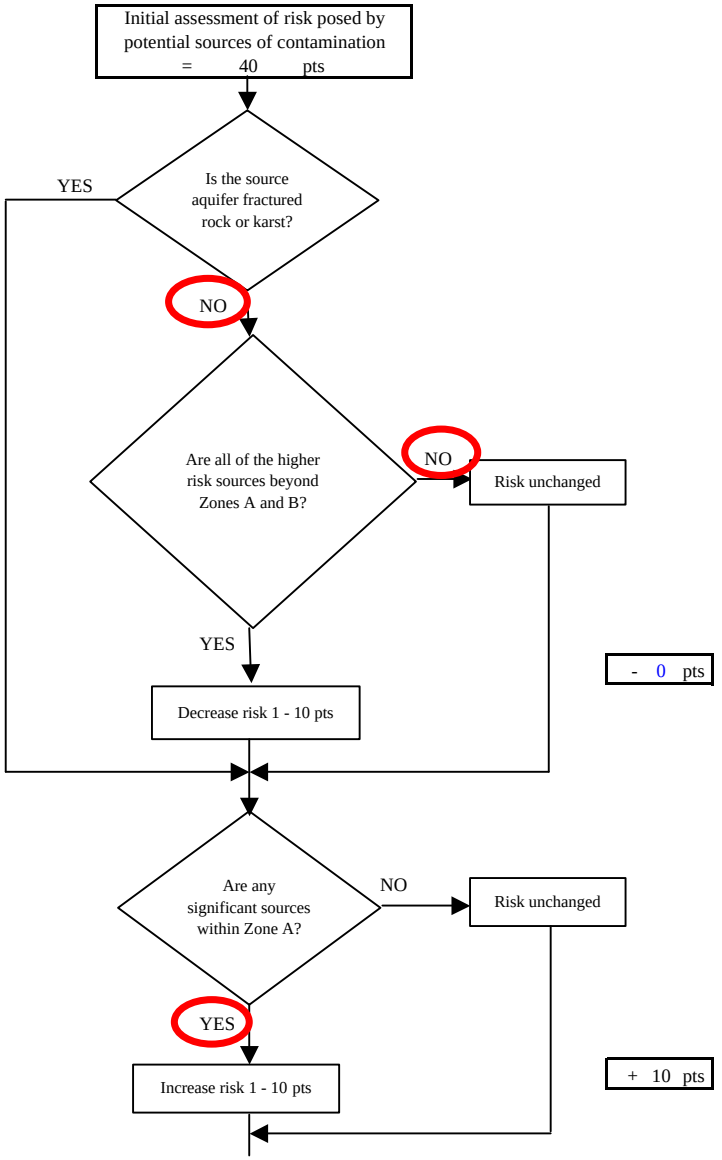


Chart 5. Contaminant risks for Indian House (213441.001) - Nitrates and Nitrites

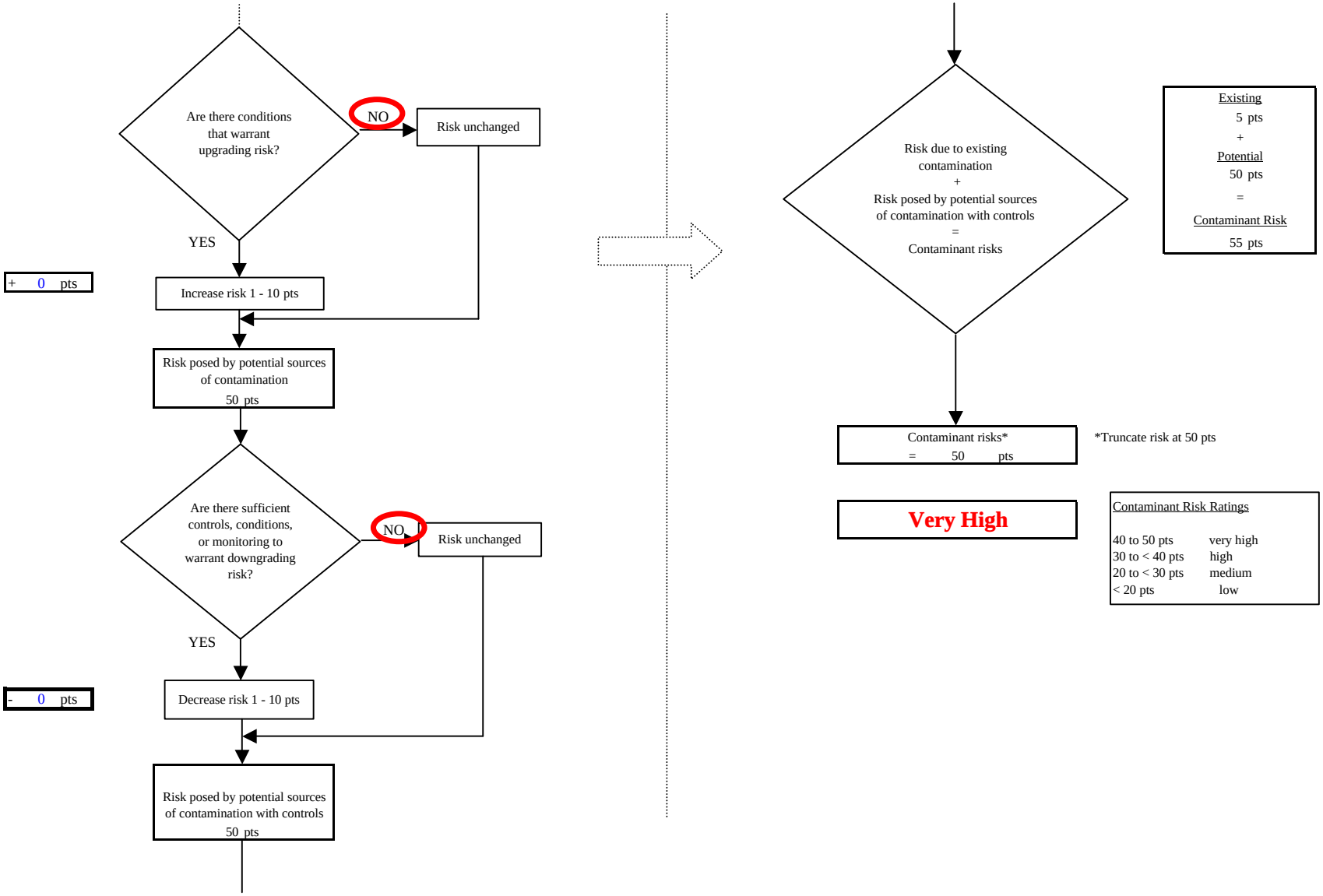


Chart 6. Vulnerability analysis for Indian House (213441.001) - Nitrates and Nitrites

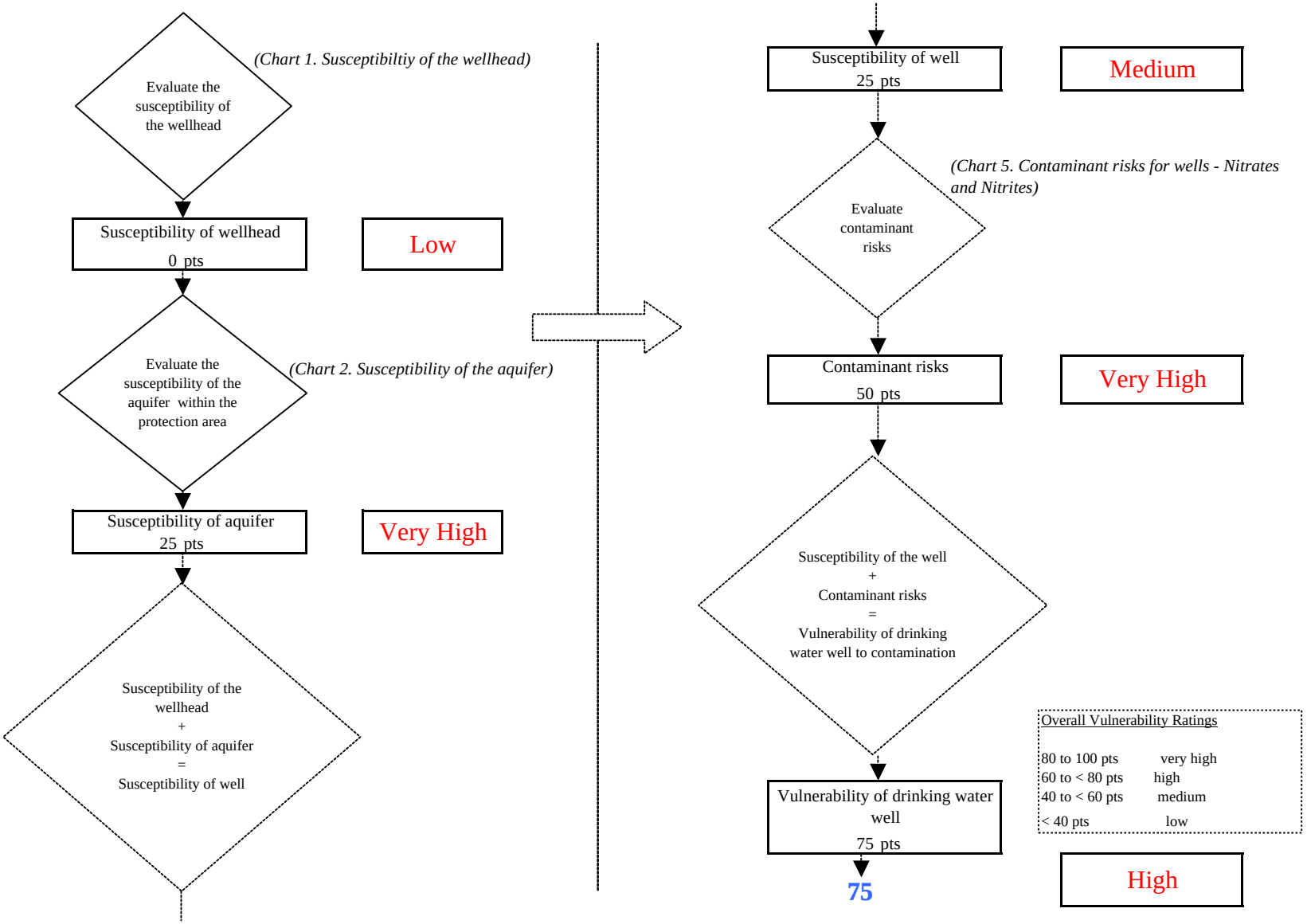


Chart 7. Contaminant risks for Indian House (213441.001) - Volatile Organic Chemicals

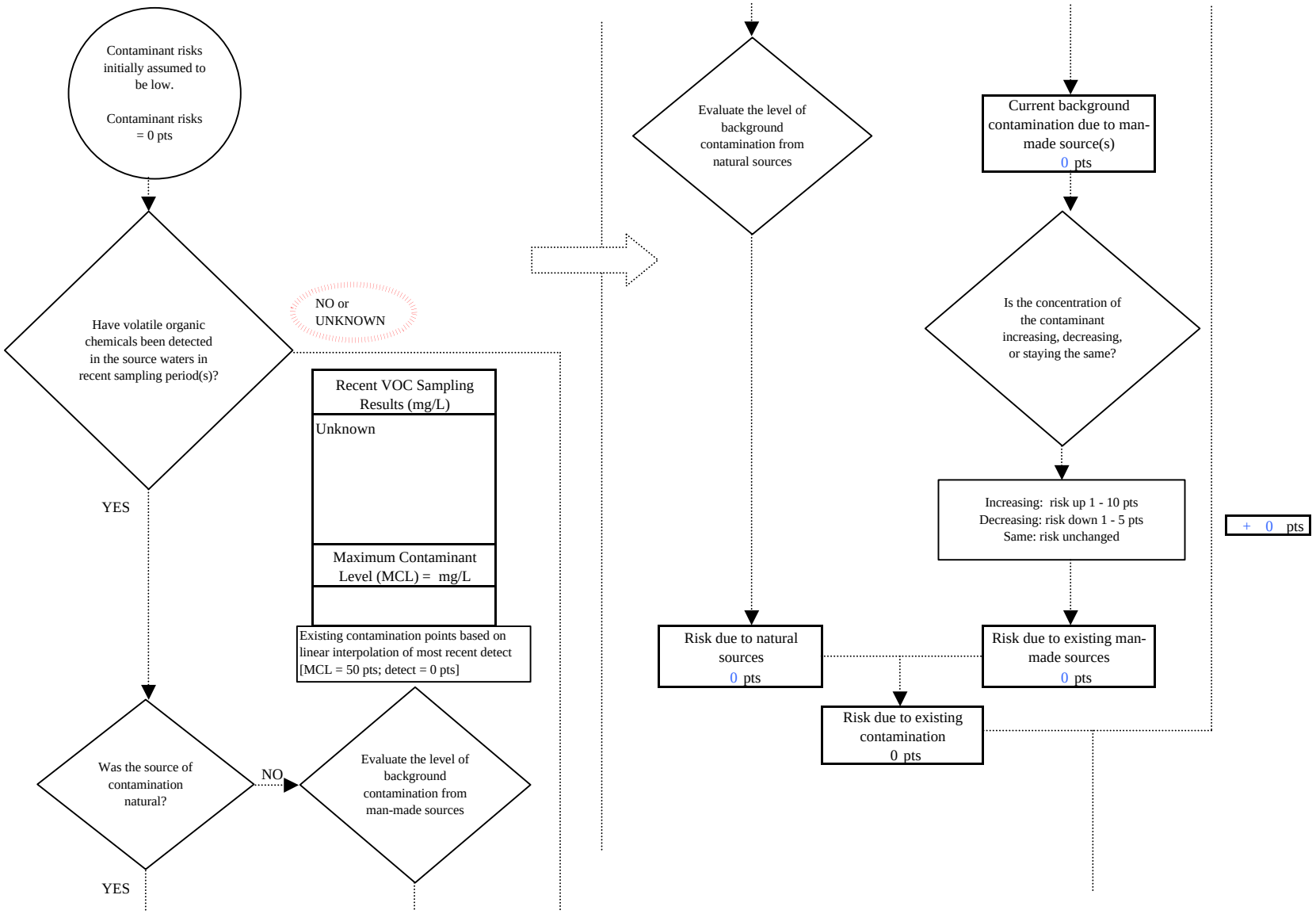


Chart 7. Contaminant risks for Indian House (213441.001) - Volatile Organic Chemicals

+ 30 pts

What level of risk is associated with the highest and the next highest risk sources(s) of contaminants identified in Zones A, B and C?

Risk Levels for Contaminant Sources identified in Zones A, B and C

	Zone A	Zones B&C	Total
Very Highs(s)	0	0	0
High(s)	1	0	1
Medium(s)	1	0	1
Low(s)	7	0	7

	LOW 10 pts	**MEDIUM** 20 pts	**HIGH** 30 pts	**VERY HIGH** 40 pts
LOW	[3] 10 sources + 10 pts	≥ 10 sources + 5 pts	≥ 20 sources + 5 pts	----
MEDIUM	----	≥ 2 sources + 5 pts	≥ 5 sources + 5 pts	≥ 10 sources + 5 pts
HIGH	----	----	≥ 1 source + 10 pts	≥ 2 sources + 10 pts
VERY HIGH	----	----	----	≥ 1 source + 10 pts

Matrix Score 30

Note: Septic systems, sewerlines, and roads are each assigned a risk ranking for each individual contaminant source in the CSI. The VA, however, counts these contaminant sources as a group and assigns a calculated number of either "lows" or "mediums" based on the density.

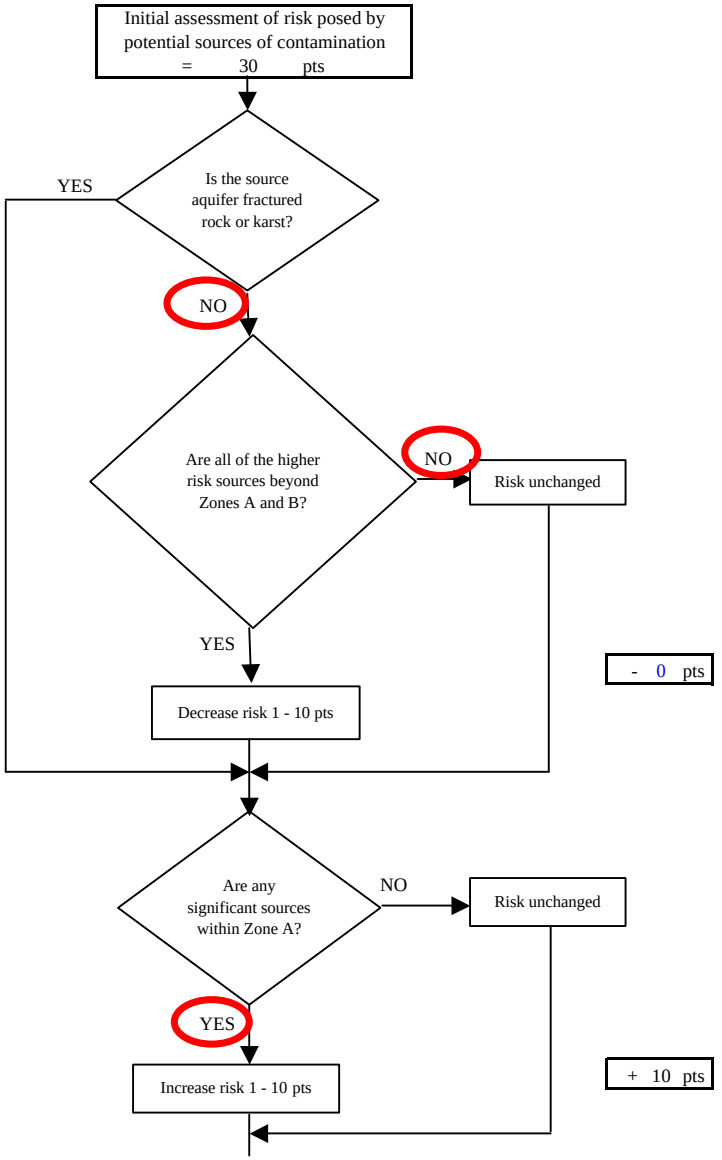


Chart 7. Contaminant risks for Indian House (213441.001) - Volatile Organic Chemicals

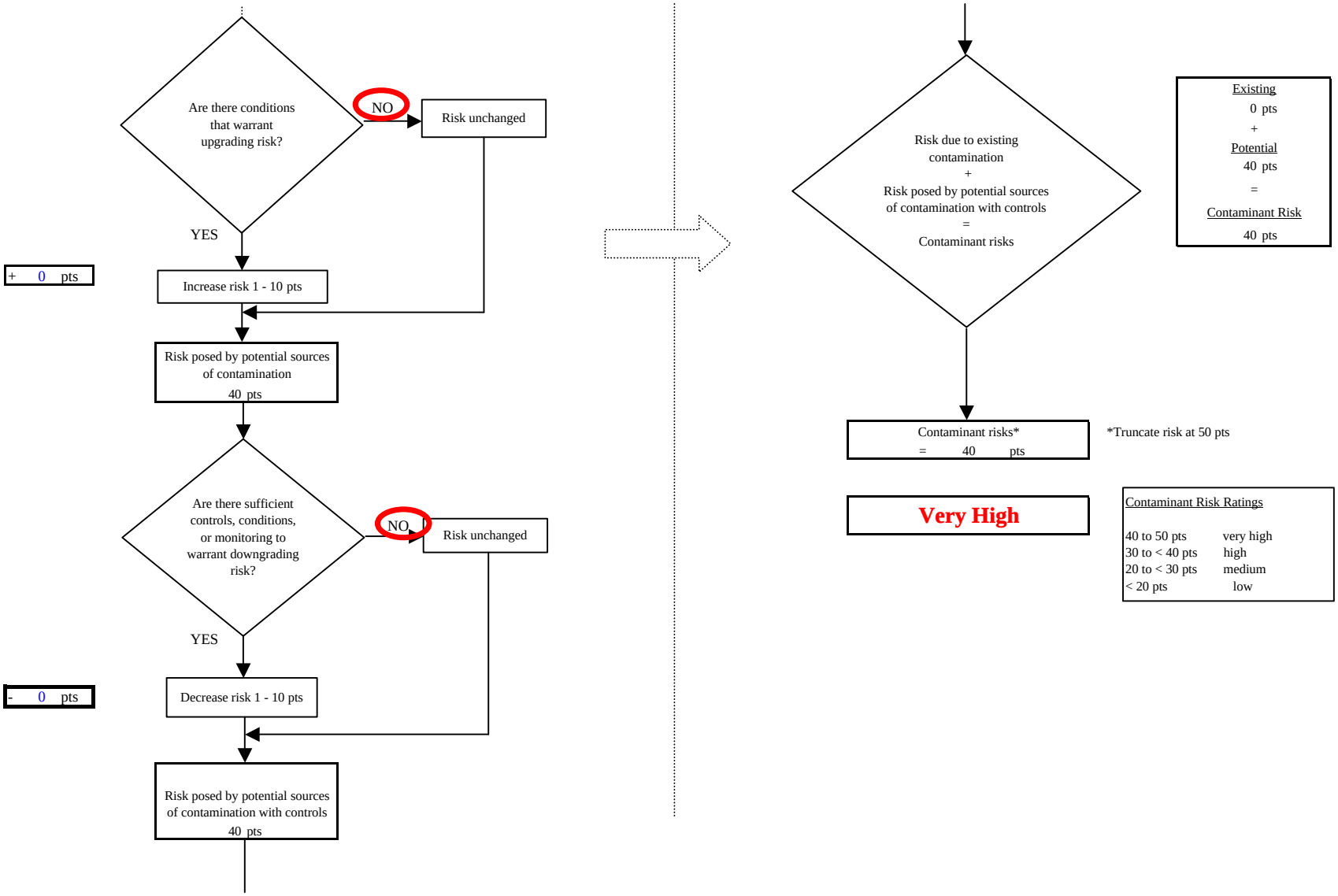


Chart 8. Vulnerability analysis for Indian House (213441.001) - Volatile Organic Chemicals